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Executive Recruitment

A very important announcement was made recently by Mr. Ernest Bevin, the Minister of Labour and National Service, on the subject of the employment after hostilities of men and women qualified to undertake responsible work in the professions and higher branches of industry. Lord Hankey has presided over a Committee charged with the working out of a scheme to this end. The fact that a special committee has been set up is a tacit admission that the ordinary labour exchanges have in the past failed to handle successfully the re-employment of industrial executives to cater for the professions.

The scheme now outlined involves the establishment in the eleven regional centres into which the country is divided of an employment office, with two additional ones situated in Liverpool and Glasgow. The next step has been the establishment of a Careers' Research Section, which already has collected information about professions and callings in collaboration with the professional institutes, educational bodies and Government departments. A committee under Lord Hankey's chairmanship has taken evidence as to the prospects offered by the various careers, and the results are shortly to be made available in the forms of a comprehensive handbook and a series of booklets devoted to individual careers. Next, funds are to be made available to the appointments officers for financial assistance to be given to enable suitable qualified persons to undertake or continue education or training for a career.

A statistical department is to be set up which will collect and disseminate information as to trends in employment. Where there is a proposal that an applicant for a post should invest capital in an enterprise, then in appropriate cases he will be advised as to the inquiries he should pursue before reaching a decision. Amongst the methods to be utilised for interesting all persons and organisations able to interest the Appointment Offices is the creation of National Advisory Committees. These will include the ones already in existence—architecture and public utilities; chemistry; civil, electrical, and mechanical engineers, and scientific research—in connection with the Central (Technical and Scientific) Register. The new organisation will collaborate closely with the University Appointment Boards. This may be a useful trend, as the foundry industry has in some respects been disappointed in the past with the operation of these Boards. Co-operation is also promised with other professional job-finding media, such as the great national institutes, whilst the overseas employment of technicians is to be featured.

There is one feature, not specifically mentioned in Mr. Bevin's announcement, and that is the clipping of the wings of the spurious job giver. One well-known metallurgist when quite young accepted an overseas appointment with the combination of an undischarged bankrupt and a non-existent company. He worked two months before discovering the true situation, and was thereafter a poorer but a wiser man. Other cases have come to our knowledge where an employment contract made in London has been repudiated when the applicant has arrived overseas on the ground that it was not a legal instrument and a lower salary has been imposed and *force majeure* temporarily accepted. It will be noted that the scheme involves in some cases the training of the applicant. This is constantly being encountered in many different spheres. It is true to state that the industry or profession which can most quickly supply the necessary teachers will get the best return for the efforts made. Thus we most strongly counsel the foundry industry to release suitable men as soon as possible to attend courses in which training will be given in pedagogy, supplemented by revision classes covering the normal professional requirements.

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EARLY INDUSTRIAL DESIGN

During a recent visit to the Beckton Works we were impressed by the decorative nature of some of the cast-iron housings of the meters which register the quantity of gas leaving the works. We were informed that these were of simple design when compared with the earlier models now no longer in existence. However, a photographic record had been kept of this type, and this is reproduced in Fig. 1. Showing the influence of the great exhibition, it was cast round about 1860. A rough translation of the Latin inscription reads: "Whereby we may be able to work by reliable indications." Fig. 2 shows one of several built in Edinburgh by Bruce Peebles about 1879, whereon the scarring due to being hit by bomb fragments is apparent. It is no reflection on the foundry industry that this model lacks artistic merits, the ratio of width to height being,

FIG. 1.

to our mind, grossly out of proportion. The industrial designer of that period must be held responsible.

The modern meters which are installed at the side of the one we illustrate take up but a fraction of the space. Thus a study of the history of the design of large volume gas meters shows how through the last hundred years the ironfoundry has responded to the changing needs of engineering practice and gives hope that the future is by no means as dull as some pessimists would have us believe.

The address of Mr. W. Thomas, F.I.C., hon. secretary of the Institute of Vitreous Enamellers, is now Bates' Yard, Rickmansworth Road, Chorleywood, Herts (telephone: Chorleywood 493).

"A FEW (NON-FERROUS) FOUNDRY STUDIES"

Mr. W. G. Mochrie, of the Tyseley Metal Works, Limited, of Birmingham, and Balfour House, Finsbury Pavement, London, E.C.2, has presented us with a book—typewritten, illustrated by photographs, and bound in an attractive loose-leaf system—which sets out the results of a few personal investigations in the non-ferrous field. The first relates to a consignment of traverse rings for gun mountings, which in general failed to meet the specified tensile properties. Then there is set out the effect of casting temperature on the mechanical properties and microstructure of man-

FIG. 2.

ganese bronze; little variation from standard is shown. A set of figures and two photomicrographs show the influence of remelting a manganese bronze alloy.

Test-bar Practice

A quantity of work has been done on test-bar practice, using the twin type pattern which has been proposed for standardisation, using a variety of alloys, cast into greensand moulds. No comments are made—only the results are detailed and illustrated. Finally there are some notes on the "Cause of Accentuated Attack on an Aluminium Bronze Alloy Under an Acid Test." The object of the book is to illustrate a service which is available to the smaller type of foundry, which does not possess laboratory facilities, and in this sense it very adequately fulfils its objective.

THE PRINCIPLES OF MECHANICAL HANDLING*

Obtaining maximum results from plant laid down for post-war production

By J. V. SMITH

Introduction

Much has been written on the subject of mechanical handling. Many approaches have been made, from the designer's angle, the manufacturer's angle, and the experienced user's angle. Complete plants have been described, and individual units have been analysed. Clever, admirable and excellent though this literature may be, it has generally been confined to pure technical data, large mass or semi-mass production plants, semi-technical descriptions of individual units, or scientific discourses on work routing and the like—more often than not on *a* particular type of plant or layout.

Little can be found that would assist the potential user of mechanical aids in handling to approach his own peculiar and particular problems along the correct lines, enable him to investigate possible applications, analyse his requirements, assess savings or estimate ultimate efficiencies of alternative systems from basic principles.

The endeavour here is to indicate and enlarge upon the basic principles within the limits of this Paper. It must be borne in mind that British industry is largely built up of a great number of very small people. The foundry industry is an excellent example. It has been authoritatively stated that 12 per cent. of the ironfoundries produce approximately 75 per cent. by weight of the country's castings. Conversely, then, 88 per cent. of the ironfoundries in this country are so small that collectively they produce no more than 25 per cent. of the country's output.

It is hoped to treat the subject in such a fashion that the smaller firms and establishments, not wealthy enough to possess planning or layout engineers, may prepare for themselves an intelligent survey of their handling methods.

The Principles of Mechanical Handling

In attempting to arrive at the basic and fundamental principles covering the use of materials handling equipment it is perhaps advisable first to define the terms "handling" and "equipment."

"*Handling*" is the lifting, carrying and setting down, in any direction, of any materials in the raw, semi-processed, or completed forms, and should include the movement in a similar fashion of any tools, equipment or appurtenances.

"*Equipment*" refers to all forms of mechanical aids used in handling materials, from the individual unit or accessory to complete operating systems. It should be stressed that under this heading occasional, intermittent and continuous forms of equipment from a lever, roller or wheelbarrow, to the most elaborate conveyor, must be included.

In the manufacturing, processing or distribution of any product or commodity, *handling* is necessary, and in every case some form of *equipment* is used. Every particular type or form of equipment has been designed for a specific purpose, and under the precise set of circumstances for which that particular type of equipment was designed, no other will prove so efficient or so economical. There is an application for the wheelbarrow, and there is a place for the continuous conveyor; the two cannot be economically interchanged. The handling of materials through process of manufacture is only in rare and extreme cases a necessary part of a production process.

To manufacture any given product, a certain minimum number of necessary production operations must be performed by whoever undertakes that manufacture. These necessary operations would have approximately the same labour cost in any number of works equipped with similar production machinery. There is then a minimum labour cost in the manufacture of a given article upon which further saving cannot be made. Between these necessary production operations, however, lies that costly field of handling, picking up, putting down, stacking, sorting, inspecting, transporting and rehandling back into work route of the materials being processed. This is the field upon which it is necessary to concentrate for, it must be borne in mind, none of this handling is a necessary production operation.

For manufacturers to appreciate fully the colossal drain of resources represented by this field of handling, they must consider the tremendous total weight handled daily in manufacturing their products. There are few executives who would not be amazed upon learning the weight handled to product weight ratio obtaining in their own plants. Many materials handling ratios have been published which differ considerably; this must be expected, depending as it does upon plant, layout and product. It is sufficient to quote one particular case, invested personally by the writer, where the materials handling ratio was between 140 and 150 tons of materials handled per ton of finished product through the gate. This plant, it is interesting to note, was a malleable-iron foundry.

It is only when ratios of this description are assessed that some appreciation is gained of the vital importance of installing and adopting the best mechanical handling methods and equipment available. Further investigation of the materials handling ratio will show that the cost of most products are almost directly proportional to the cost of handling through the manufacturing plant.

* A Paper read before the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen, Mr. G. R. Shotton presiding. The Author is Joint Technical Manager of the New Conveyor Company, Limited.

The Principles of Mechanical Handling

The Time Lag

Another important point brought to light during this investigation will be the length of time the materials constituting a particular product are actually being worked upon during their progress through the factory. This time is on an average one-third, but in many cases as low as one-sixth, of the total time spent in the plant. This holding of materials and products in the factory is important, so much so that work in process has been described as the "graveyard of profits." To speed up turnover is the surest way to reduce the costs of material control.

Taking this time question a stage further brings the subject to the consideration of skilled operatives, and the amount of time spent in the works that is actually devoted to the particular operation or process upon which they are employed. It is not for the skilled moulder to carry cores from the coreshop or wheel castings to warehouse, nor for the skilled machinist to seek his raw materials or transport his finished products back to stores. It is an essential part of any solution in materials handling problems, that skilled operatives should not be interrupted, kept waiting for materials, nor should they have to shut down or leave their machines or processes in order to handle material.

Influence on Production

Increased production due to an uninterrupted steady flow of materials to and from operatives can be well illustrated by quoting an example with which the Author was associated. A certain munition plant was turning out approximately 33,000 units of a particular type and size per week. The units were being handled from operation to operation in batches. Congestion and delay were apparent, and it was decided to conveyorise the factory in order to increase production to meet a serious demand. With fundamentally the same layout, the same number of machines and operators, and the same number of hours worked per week, but with the addition of conveyors, production was stepped up to approximately 92,000 units per week. This result was achieved merely by ensuring a steady flow of materials to and from the operatives, and by incidentally introducing a rhythm or pace to production.

Practical Hints

To introduce flow of materials through process it is necessary to study the layout of the various departments constituting the factory, to consider and analyse the work route of all materials or components, and to beware of back tracking or retrogression. Never transport materials farther than is necessary to maintain flow.

Materials should be routed through the works in such a fashion that they reach specified operatives or machines at the required time, and by such means that high handling charges and congestion are avoided, and also that the finished articles reach inspection, assembly or packing points in correct sequence.

The arrangement of mechanical means to ensure production flow is not the complete solution to speeding up production and reducing handling costs. Certain isolated handling units can be operated without being synchronised with other operations, but where conveyors and the like are used as pacemakers it is of vital importance to synchronise the issue of all materials, plant or process loadings, inspection and despatch departments. All progress scheduling, from incoming materials to outgoing products, must be co-ordinated to maintain equipment operation on a productive basis.

Batch Handling by Schedule

Many processes used in manufacturing deny the introduction of flow methods, and determine that articles undergoing these processes can only be economically handled by batch system. But even under these conditions, much can be done to reduce handling charges. Again, work routes must be carefully plotted and studied. Whatever method of batch handling is used, wheelbarrow, industrial power truck, tractor and trailers or stillage system, the carrying medium must not be allowed to run around empty. Analysis of the route will generally show that trucks can work progressively through the plant from department to department, always with a full load. Coupling the time factor with this analysis of route, often brings out that at regular specified times material is ready for progression at specified points.

This fact indicates that movement of trucks can be scheduled in such a manner that they may operate to timetables over specified routes. This principle may be extended to include other intermittent handling plant, such as travelling cranes and the like. Definite scheduling will assist in better routine and materially increase handling capacity. Lost or waiting time of any handling unit can be as costly as the lost time of a production machine. To assist scheduling and to simplify organisation, teach operators the possibilities of their equipment until they study their deliveries with all the seriousness of baker's roundsmen. Work also on the various departmental foremen to make them traffic conscious. See that materials are dumped readily to hand for the operator who requires them, not in some empty space regardless of situation.

Major problems in handling generally present themselves, but minor points, too, are worthy of consideration, for collectively they are a cause of inefficiency. Look for the case where a number of men are engaged upon moving materials that one man could move with mechanical aid, where men are lifting articles weighing upwards of 90 lbs., and where materials are being transferred from one container to another.

Whoever undertakes to survey handling methods, or investigate problems, should learn all they can of equipment or combinations of equipment readily available from reputable manufacturers. They should keep pace with the progress and improvements constantly being made. In selecting equipment for a given problem, be sure first that the solution is the simplest,

that the equipment is the simplest, and that the arrangement is flexible enough, in case of accident or breakdown, that nothing hinders the work being done by more primitive means.

It will often be found that several different types of equipment will provide a satisfactory solution to any one particular problem, in this case the deciding factor should be operational cost per unit of work, not first cost of equipment.

Operational cost per unit of work must not be confused with electrical or mechanical efficiency. A machine may be mechanically perfect, but if unsuitably applied its functional efficiency may be nil. A comprehensive survey of present and proposed methods, plus commonsense and a reasonable knowledge of available machinery, will generally assure a correct selection of equipment to overcome a given problem.

Looking Ahead

Manufacturers of handling equipment are always ready to place their technical knowledge and experience at the service of a prospective client, but it is up to the client to make the first approach to his problem or problems. To make sure that a particular problem is really the first that should be tackled, to make improvements progressively with a definite plan in mind, having due regard to layout modifications or extensions that may be necessary in course of time. When considering specifications of equipment, get together with the manufacturer and be guided by his experience. The right type of handling equipment, correctly applied, and bought on specification rather than price, is just as reliable as production machinery. Where breakdowns occur, or maintenance is unduly high, the trouble can generally be traced to unsuitable application, overloading or lack of care. Handling equipment should be intelligently used, and should receive the same maintenance and periodic overhaul as that given to production units.

When considering relative costs between various methods of handling materials, saving in man-power has generally been the only consideration, other factors, however, should be given thought. Where mechanical methods are to supersede manual labour due regard should be paid to mechanical control, pace, progressing simplification, reduction of accident risk and the cutting out of human element.

In computing actual savings accrued by the installation of mechanical equipment, two important factors are often overlooked. The first is the reduction in overhead charges by the amount of indirect labour saved. The second is the value of extra production, since improved methods result in more production in a given time, which is equivalent to a reduction in direct cost.

Unfortunately, it is almost impossible to lay down definite formulæ for the assessment of comparative costs due to the many varying factors encountered. No two plants perform the same functions under precisely the same set of conditions, nor would they be likely to have superseded the same methods.

In conclusion it must be emphasised:—

First, that no increased economy will be secured unless a start is made.

Secondly, that at the present time much thought is being expanded on new manufacturing plants and layouts. The forthcoming changeover from wartime to peacetime products will present industry with opportunities to reorganise and modernise to a degree unparalleled in its history. It is generally acknowledged that competition will be fierce, and that every manufacturer will strive by all the means in his power to face this competition equipped with better plant, a better layout, and a more efficient organisation than is possessed by any of his competitors. In this reorganisation mechanical handling will play an increasingly important part. The greater majority of this country's manufacturers have, in the past, been remarkably reluctant to accept mechanical handling at its true value, or have been too conservative to modify either their layout or methods to any degree which would enable them to enjoy the full advantages which accompany the correct use of mechanical handling equipment. This is, unfortunately, true to the extent that at least one national industry cannot muster a member who has taken *full* advantage of the equipment available. Whilst the greater part of the blame for this state of affairs must be laid at the door of industry, part of it must inevitably fall on the manufacturers of mechanical handling equipment to a greater or lesser degree.

Too often in the past has the industrialist dictated to the plant manufacturer exactly what type and form of conveying equipment he required, in spite of better advice, and in spite of the fact that this decision was arrived at with insufficient knowledge of the many types of plant available.

On the other hand, at least two great industrial organisations have instituted their own equipment departments for the manufacture of conveying plant, on the grounds that handling equipment manufacturers were not prepared to come along and study their peculiar problems at length, or that they could not obtain the degree of service required.

It is hoped that these notes have discovered a certain amount of common ground and unearthed a few basic principles which will enable users of mechanical handling equipment, present and potential, in conjunction with manufacturers, to obtain maximum results from plant laid down for post-war production.

DISCUSSION

A vote of thanks having been accorded to the lecturer on the proposition of Mr. N. C. Blythe, seconded by Mr. B. Gale, MR. J. J. SHEEHAN referred to the suggestion in the Paper that, in the post-war period, it will be necessary to consider the mechanisation of foundries on account of the competition which is likely to arise. Mr. Sheehan thought they were all willing to give the matter consideration, not in view of possible competition, but because of the increased cost of labour and lowered output. The question of cost, however, was a serious one. For a small mechanised unit they would probably have to pay anything from £10,000 to £15,000.

The LECTURER said he was not prepared to accept the figure of cost quoted, which was exorbitant.

In reply to Mr. J. Hird, who asked for some indication of the weight handling ratio, MR. SMITH expressed

The Principles of Mechanical Handling

the opinion that if they got a ratio of 80 or 90 to 1 it would be a good figure. In highly mechanised plants the figure should be around 60 to 1.

MR. A. J. SHORE spoke of the difficulty of getting people to work in foundries, and asked the lecturer for some guidance as to how the case could be put to the workers in order to convince them that mechanisation was to their advantage.

MR. SMITH said he was an engineer, not a psychologist. Unfortunately, or should he say fortunately? the manufacturers of mechanical handling plants never had to work them. Relations with labour, or the offering of inducements to labour to operate mechanised plants, were problems which they passed on and were extremely relieved to do so.

Sand Hopper Linings

There was some discussion on the shape of hoppers and methods of preventing sand from adhering to the walls. It was stated that in America the lining of the inside of hoppers with stainless steel sheet had been tried. MR. SMITH mentioned that some time ago he made the experiment of lining a hopper with Staffordshire blue tile, which had a very smooth surface, and very hard wearing qualities. The results were very good indeed, but the expense was rather heavy.

Answering further points, MR. SMITH said it was impossible to decide whether to mechanise or not on a hypothetical case. There must be a considerable amount of investigation before it could be proved whether it would be worth while or not. As to the relative advantages of lengths of gravity roller track or continuous conveyors, he said it depended largely upon whether the melting methods were batch or continuous. If they had continuous metal available, he thought a continuous conveyor was a better job, and that they should take the moulds to the metal rather than attempt to bring the metal to the moulds. On the other hand, where they were working on batch work, as in a malleable-iron foundry using rotary furnaces and the like, and in non-ferrous work, they had only metal available at certain periods. It was thus necessary to have some means of storing the moulds between heats, and where the moulds had to be moved it was much better to put them on a roller conveyor.

REFERENCES

"Modern Materials Handling," by S. J. Koshkin.
"Cost and Production Handbook," edited by L. P. Alford.

(*Continued from next column.*)

have been able to arrange satisfactorily for sales of their copper during the first quarter of this year, the difficulty being overcome by satisfying the needs of the United States over and above the purchases already concluded. This does not sound like a change in values for a few months, and it should be reasonably safe to predict that stability will endure at any rate for the first half of 1945. More likely in view of the military outlook in all the theatres of war there will not be any change throughout the present year.

FUTURE OF METAL PRICES

BY "ONLOOKER"

Bearing in mind what happened on New Year's Day, 1944, when the price of tin was advanced without the slightest warning by £25 per ton, the non-ferrous industry was probably relieved this year that no such upheaval took place. Actually rumour had been making free with the aluminium quotation, which it suggested would be adjusted in a downward direction to bring it more into line with the price ruling for secondary light alloy material, now standing at about £25. To market men this suggestion is one savouring somewhat of heresy, for it appears to be in line with the "tail wagging the dog," but it seems unlikely that any change in virgin aluminium prices will occur in the near future, and therefore the somewhat extraordinary gap between this grade of scrap and virgin aluminium must continue. While the various grades of virgin metals normally bear to each other relationships which do not vary much, the spread between virgin and secondary qualities is something upon which too much reliance should not be placed. In this respect we have only to study the course of brass and copper scrap prices on the open market during the course of the present war to realise the truth of this contention.

Intention of Aluminium Producers

In this matter of the post-war values of the non-ferrous metals, very great stress has been laid upon the future intentions of the aluminium producers, and it is generally supposed that they mean to bring their selling price down to something like half its present value, *i.e.*, to £55 to £60 per ton. Whether this is true or not remains to be seen, but since the production of aluminium potential and actual has expanded enormously during the war, it is not surprising that the policy of the light-metal interests commands a considerable amount of attention. Obviously the price of aluminium must influence the copper quotation, for the two metals are competitive over a fairly wide field, but it may be doubted whether the aluminium interests will cut their selling price so severely as the present level of secondary light alloy material appears to suggest. At the moment conditions are, of course, abnormal, and there is probably a certain amount of "jockeying for position" among vital commodities, but bearing everything in mind, and looking forward to a period perhaps some years after the war, when more stable conditions will obtain, we may well see copper at about £50 and aluminium possibly some £20 dearer.

Outcome of Talks

Rumour was busy during the concluding weeks of the old year with suggestions that not only would there be a cut in the price of virgin aluminium, but also a reduction in copper, this resulting from the talks in progress during December and January between the Government and the Empire producers. At the time of writing no official intimation has been given out regarding these discussions, but it has been reported that both Canadian and Rhodesian producers

(*Continued at foot of previous column.*)

METHODS AND PROBLEMS INDIGENOUS TO A GENERAL ENGINEERING IRON-FOUNDRY

The jobbing shop as a training ground for moulders

By WILLIAM MONTGOMERY and JOHN DOIG, Junr., Leven

(*Continued from page* 33.)

"Salt Box" Casting in Greensand

The type of casting dealt with in Figs. 16 to 19 is a common component in chemical engineering plant. The only surfaces on which machining is carried out are those on the top flange and on the side and bottom outlet pads. It will be noted that this method of moulding is an extension of the loam skeleton pattern practice previously described to greensand work. The foreman's first care is in the choice of a suitable moulding box. In these jobs the box size is important from the angle that if the box is much larger than is actually required to hold the pattern and accommodate the gating system, the extra ramming necessary might upset time estimates.

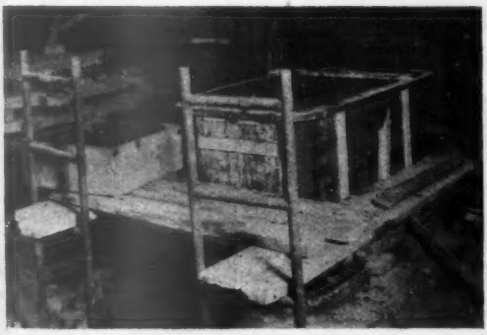

FIG. 13.—STILL CASTING: CORE BEING BUILT UP IN SKELETONS.

The drag is set and levelled and the skeleton pattern placed in position. After ramming the sand to the bottom flange, the first parting is made. The mid-parts are then placed in the guide pins on the drag and the sand rammed to the top flange. A dummy core is next rammed within the pattern and strickled off to shape by means of the sweep board as shown in Fig. 16. This also shows the top flange parting. The top part is placed, rammed over the dummy core, and then removed. The next step involves the removal of the dummy core, unscrewing the various sections of the pattern and withdrawing the latter.

The mid-part may then be lifted, and while this is being finished the patternmaker re-assembles the pattern for the core making. (See Fig. 17.) As this core is vented solely through the drag it is most important to ensure free escape of steam by having a good bed of ashes. Artificial venting by means of pricker holes from the top of the core to the ash bed is a wise precaution.

The metal thickness at the top of the core is obtained by adding a strip of wood of the required dimensions to the original sweep board and corners are also swept to the required radii in the usual manner. It is a simple matter now to remove

FIG. 14.—STILL CASTING: LOAM CORE.

the pattern, finish core, replace mid-parts and close the top. Fig. 18 shows the finished core while Fig. 19 illustrates the assembled mould just prior to closing the top part. The gates are cut from the down runner at the top and bottom flanges. The gates on the top flange give a flow of hot metal over the core top after the lower gates have done their work. Unless the sand is particularly permeable and of satisfactory hot strength it is impossible to obtain sound castings of this nature in greensand without having the iron extremely fluid. This involves keeping the silicon content above 2.5 per cent., and the carbon in the region of 3.2 per cent.

Methods and Problems

Jobbing Foundry Problems

As illustrative of the types of problems which confront the jobbing foundryman we may cite the following examples:—Fig. 20 shows a cast-iron bedplate which is cast as part of a milk-bottle capping machine. It is later planed accurately over the top face and hence it will be appreciated that, for the casting to lie perfectly flat on the planing table, the proper camber must be applied to the pattern during ramming. This is usually done in a jobbing shop by tying or weighting the pattern-ends down until the desired camber is obtained and then proceeding with the ramming. This is by no means the whole story; the first casting may cool just as was calculated and be "dead flat"; but unless the metal analysis is kept fairly constant, there is no guarantee that each of the following ones will follow suit. Lower silicon mixtures will warp more under contraction stresses than the higher silicon irons will. One other point worth mentioning is the existence of a square box-shaped cavity at the bottom of the casting (shown at the bottom-right in the illustration). This is cored out with an oil-sand core, and unless immediate stripping of this core is carried out after casting, the thin tie bar which forms one side of this small box section will assuredly break.

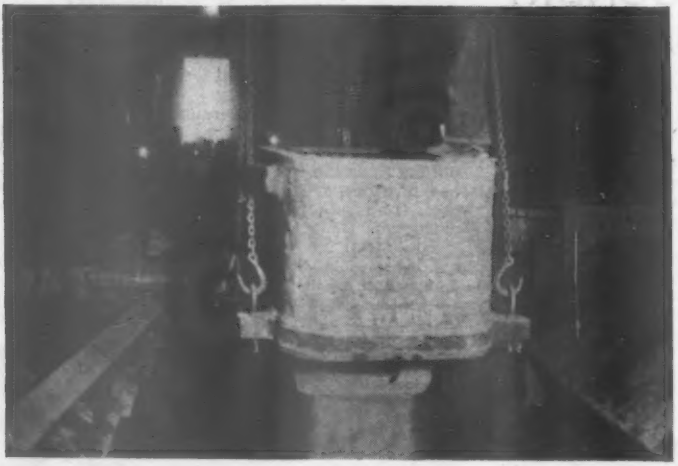

FIG. 15.—STILL SECTION. COMPLETED MOULD BEING ASSEMBLED.

FIG. 17.—"SALT BOX" CASTING. SKELETON PATTERN REASSEMBLED FOR CORE MAKING.

Fig. 21 shows an austenitic iron casting weighing 30 cwts. It is used in a large oil-fired enamelling muffle furnace as a supporting rack or perrit for heavy steel equipment. The problem in this case lay in the consideration of the best method of supporting and venting the long oilsand cores which form the box sections at each side of the rack. A compromise between design difficulty and casting strength was effected by coring holes on the top of the box sections at regular intervals to effect the dual purpose of venting and at the same time supporting the main cores. Of course, a certain amount of strength in the finished casting was sacrificed, but, in spite of the small cracks which developed at the sharp corners of these cored-out holes, the casting has given many months' service in conditions of intermittent heating to

and cooling from 900 deg. C. and for aught the Authors know, will continue to give many more.

Centrifugal Pump Castings

This type of casting is very commonly seen in engineering shops. Whilst individually the designs and sizes are as varied as are the whims of the designers, yet as a family they do Trojan service in the wide field of chemical engineering, and hence one reason for their regular appearance in the shops of the jobbing founder. They are the hardy perennials that seem to thrive in dry sand.

The casting to be discussed had a large flange joined by two webs to the centre boss. The mould was in greensand, but the top flange and centre boss were formed by oilsand core assembly.

The main difficulty about the whole design was that the latter provided for a comparatively thin, isolated and overhanging wedge of sand between the flange and boss. This obvious fault was exorcised partially by re-designing the webs so that the sand at this part was not so entirely cut off by surrounding metal. One of the Authors has made mention of this elsewhere, but this design difficulty is so often the cause of shrinkage defects that it is felt that reiteration will not be condemned.

Fig. 22 is a radiograph showing the location and extent of the shrinkage defect at the base of the flange or seating. The seriousness of the defect lay in the fact that all the castings which showed radiographic indications of shrinkage, leaked very badly at this spot. No sudden change of sectional thickness is indicated such as would lead one to expect shrinkage as a logical result, and certainly the moulding methods were not mis-begotten, considering the numbers off and the equipment at hand. Foundrymen will recognise that this defect is caused by what is known in the literature as the "Leonard Effect," although many of the investigations were done by Fletcher and others. Briefly, it may be said that overhanging or projecting parts of the mould, which are partly surrounded by

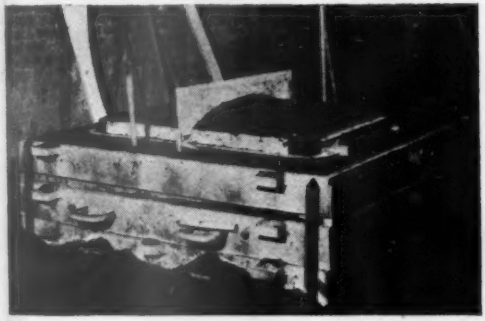

FIG. 16.—"SALT BOX" CASTING. STRICKLING THE DUMMY CORE TO SHAPE.

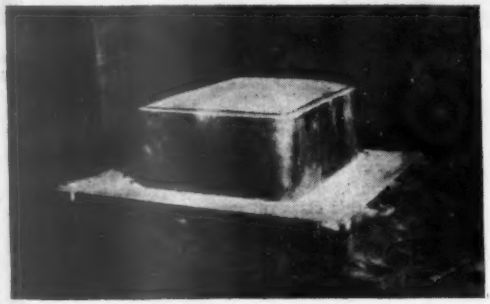

FIG. 18.—"SALT BOX" CASTING. SHOWS FINISHED CORE.

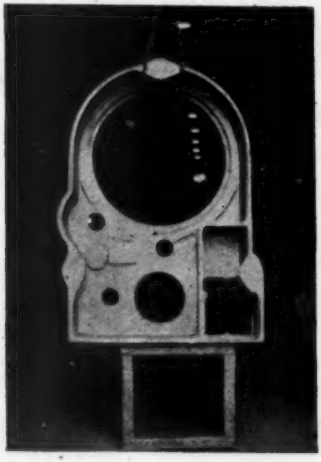

FIG. 20.—CAST-IRON BOTTLING MACHINE BEDPLATE.

FIG. 21.—AN AUSTENITIC PERRIT CASTING WEIGHING 30 CWTS.

Methods and Problems

molten metal, become exceedingly hot, and in extreme cases the mould surface at that particular projection rapidly approaches the temperature of the molten iron. The resulting hot spot tends to hold the adjacent metal in a fluid or pasty state after the neighbouring parts have solidified, and naturally cavities will be formed in this, the last part of the casting to solidify.

In the casting under discussion, exactly this has occurred.

The cavity has formed below a projecting wedge of sand which, to aggravate matters, lies in the path of the primary flow of metal in the mould. Two remedies are obvious. The metal may be poured at a lower temperature, but this is most unsafe for the risk of trapping dirt and occluding gas is ever present with low-temperature pouring. The second method would be to chill or, at least, to sprig the sand at the critical part with the object of conducting the heat away more quickly from the sand surface.

The action which, in this case, finally improved matters to the extent of inhibiting leakage under pressure was that of reviewing the gating methods and adjusting the metal composition.

Compressor Cylinders for Refrigerating Plant

The casting shown in Fig. 23 is worthy of note only because it belongs to a type which gives trouble in the jobbing foundry solely by reason of chemical composition. It is a high-pressure (500 lbs. per sq. in. test pressure) cylinder, and is moulded in dry sand in a perfectly straightforward manner, using a split pattern and running from a down-runner with cut gates on the top and bottom flanges. It is run in a low-carbon close-grained iron which is inoculated at the spout with nickel shot. Without inoculation, the iron would, of course, solidify "white." With these low-carbon irons it is imperative to cast at a high temperature. In foundry language, "one cannot cast too hot."

By reason of their higher freezing point and non-fluid nature, mould dirt or core gases are bound to be trapped, if these irons be not poured in a condition of lively temperature. The shrinkage must be taken care of by casting a reasonably heavy tapered feeding head on to the top of each cylinder. Loose detachable pieces on the pattern will suffice. If the size of these feeding heads has been correctly computed in relation to the size of the castings, then the production of these high-duty castings need not be attended by the fear that the water jackets, ports or main cylinder bores will show any signs of shrinkage defects.

These remarks may sound like platitudes to those familiar with this class of work in specialist foundries, but it must not be forgotten that a great many of the smaller general shops are not in the forefront of technical progress.

An Unusual Problem

Although the following matter describes a problem which is a little unusual, yet it typifies the somewhat

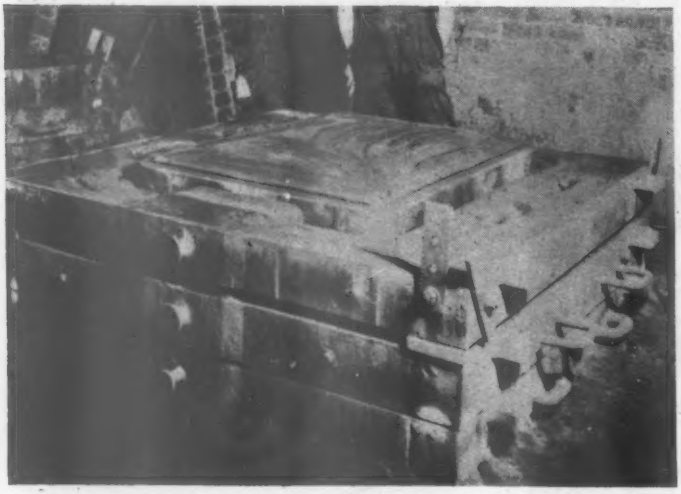

FIG. 19.—"SALT BOX" CASTING. COMPLETED MOULD PRIOR TO CLOSING TOP PART.

FIG. 23.—HIGH-PRESSURE CYLINDER CASTING SHOWING GATING SYSTEM.

odd jobs which the staff of a general shop must ever be prepared to tackle. Cast-iron hubs had to be cast-on to an assembly consisting of a mild-steel rim and steel spokes. An idea of the appearance of the completed article will be obtained by reference to Fig. 24, and no doubt the similarity between this and an ordinary tractor or steam road roller wheel will be noted.

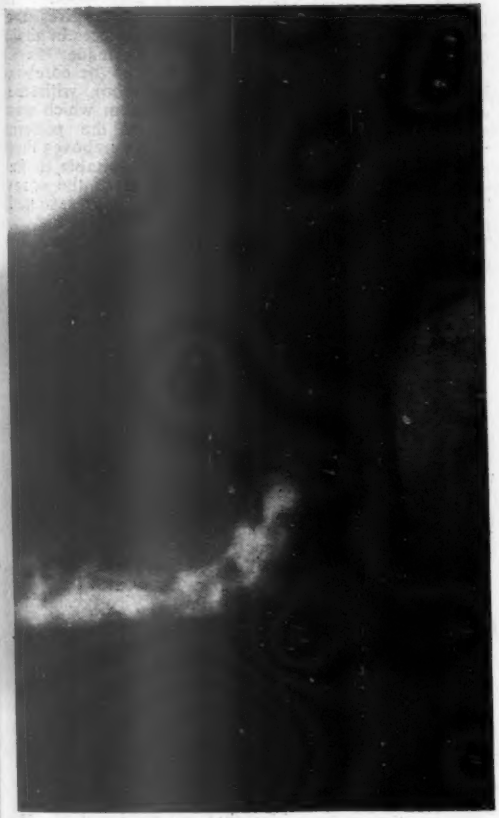

FIG. 22.—RADIOGRAPH: ILLUSTRATING SHRINKAGE DEFECT IN CENTRIFUGAL PUMP CASTING.

A cursory glance at the picture, and the casual thought of how straightforward the job is, will just not suffice in this case. The outside diameter of the wheel is 4 ft. and that of the centre hub, about 9 in. The spokes are splayed at the hub end with a view to giving them a good hold when the hub is cast. Experience forcibly demonstrated the very great stress on the spokes which the solidifying and cooling small cast-iron boss can exert. In the first attempt, the spokes were inserted through countersunk holes, of the proper pitch, in the rim and welded in position. The hub was then moulded in a corebox, using oil sand, and assembled in position with the spokes radial to, and issuing from, it on the foundry floor. The result was a complete failure. The contraction stresses set up in the cooling hub, when transmitted through the spokes to the rim, completely fractured the welding metal deposits, and drew the inside collar of each spoke back about ¼ in.

Efforts directed towards welding the rim and spokes after the hub had thoroughly cooled were not attended by success, due to the spoke collars being pulled away from the rim in an apparently unrestricted manner. The method eventually adopted, and which was completely successful, involved radical changes in technique. A jig was made and set to hold the spokes at their proper pitch and in correct relation to their positions in the hub and to the holes in the rim. The spokes, being firmly held in the jig, were riveted to the rim, with the collars making good and firm contact with the latter. The rim of each wheel was split at one convenient location between any two spokes, leaving a ¼-in. gap in the rim circle to allow for contraction.

FIG. 24.—ILLUSTRATING THE PROBLEM OF THE CAST-ON IRON HUB.

After removing the jig, the cores could be positioned *in situ* and the hub cast. As was expected, the contraction virtually closed the ¼-in. gap in the rim and a few careful runs of weld deposit again completed the rim circle without measurably affecting the concentricity of the wheel.

(To be continued.)

WOODEN COREBOX FRAMES INSTEAD OF METAL

By "CHECKER"

Instead of making coreboxes and patterns of either all wood or all metal, it can be an advantage to make them of both wood and metal. For instance, sometimes wooden corebox frames suitably battened can be made with metal for all the other parts, and where this is found practical the saving in time and money can be considerable, as no master patterns are required for the corebox frames; consequently, no castings are needed, with the subsequent saving in machining.

Fig. 1 shows a suitable instance, the corebox frame including the bottom being made of wood, while the

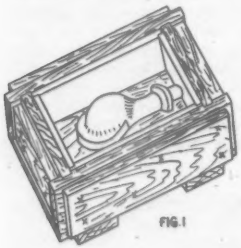

FIG. 1

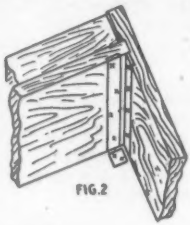

FIG. 2

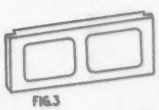

FIG. 3

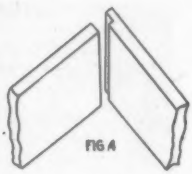

FIG. 4

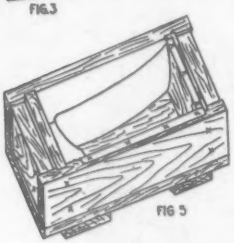

FIG. 5

rest is made in metal. It will be noticed that the corebox has loose pieces or slides forming the outside shape of the core. These are made in metal, and have to be loose owing to the undercut caused by matching the corebox taper to the pattern print, the corebox being made this way up to allow the metal section of the pattern to be fixed permanently to the bottom of the corebox.

To counteract the wear of the loose metal sides on the wooden bottom and sides of the frame, pieces of strip brass or other metal should be let into the wood level with the surface, as shown in Fig. 2. If the backs of the loose metal pieces are lightened out, as shown in Fig. 3, the metal strips let into the wood should be positioned to correspond with the parts of the metal sides that are touching the wood from top to bottom, which in Fig. 3 is at each end and the middle.

Grooves at Both Ends

It would be found an advantage to have grooves cut at both ends of the two sides to correspond with the loose ends, as shown in Fig. 4. This gives the necessary support to hold all four loose pieces in their correct position while the core is being made.

In this particular instance the inside of the corebox has the appearance of an all-metal corebox, with the exception of that part of the wood bottom which was not covered by the metal section of the pattern which is fastened in the bottom. With coreboxes that have no metal loose sides it would be advisable to fix strip metal on the top, where the height of the corebox is not already covered by metal pieces fastened to the sides to give the shape, as shown in Fig. 5. This gives an all-metal top, and better working surface for strickling.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

AN APPRECIATION

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—In your November 2 issue you published a small paragraph describing the Casting Defect Dial which we have available. Evidently, this item appeals to foundrymen, and it is also evident that your readers really study the magazine since we have already received probably 50 or 75 requests for this dial from England. Many thanks for the mention which you gave us, and our congratulations on your reader interest.

Yours, etc.,
EASTERN CLAY PRODUCTS, INC.
(N. J. Dunbeck, Vice-President).

Eifort, Ohio,
November 29, 1944.

INDUSTRIAL DESIGN

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Just a line to congratulate you on your leading article in this week's FOUNDRY TRADE JOURNAL on "Industrial Design." I have been hammering at this subject for a long time with only moderate results.

Design, as put forward by the ironfoundry trade, represents the monstrosities that we produced at the worst part of the Victorian era. This is a generalisation I know, and there are exceptions. Nevertheless, I think you have done a national service in bringing this forward.

Yours, etc.,
W. H. HARPER.

John Harper & Company, Limited,
Albion Works,
Willenhall, Staffs.
January 5, 1945.

AN INTRODUCTION TO METALLURGICAL SPECTROGRAPHIC ANALYSIS*

By D. M. SMITH, B.Sc., D.I.C., F.Inst.P.

Introduction

The colouring of a bunsen flame when certain metallic salts are introduced into it by means of a platinum wire is well known. If the colour of the flame is analysed by means of a spectroscope, one or more lines of different colour will be seen occupying definite positions. The light given by the flame has thus been separated into the various radiations which compose it, by diffraction through the prism of the spectroscope, each line being an image of the slit on which the light falls. The colours (and consequently the positions) of the lines are different for different elements, but the lines due to one element are characteristic and serve as a means of identifying it. Thus, in 1860, Bunsen discovered the alkali metals rubidium and caesium, and this was followed by the discovery of thallium (Crookes) and indium (Reich and Richter).

In addition to the visible radiations there are ultra-violet radiations, which are absorbed by glass, but they can be recorded photographically by means of a spectrograph in which all the optical parts are made of glass.

For metallurgical analysis, however, flame spectra are somewhat limited in their application, and the electric arc or condensed spark have proved more useful for this work. There are numerous variations of arc and spark discharges, and the particular type used for any analytical purpose is selected as a result of trial and systematic experiment. Thus, in a general way, an arc is used for the detection of traces of impurities and a spark for the accurate quantitative determination of alloying constituents within the upper and lower limits allowed by specifications.

Each metal gives a distinctive spectrum, consisting principally of lines of various intensities. These lines are characteristic in that they do not vary in related position (which is defined in terms of wavelength) in the spectrum of the element. Since most of the useful lines for metallurgical analytical work are in the ultra-violet part of the spectrum, photographic records are generally used.

At first sight it appears a tedious matter to identify all the lines in a spectrum, but, fortunately, this is very rarely necessary. When only small quantities of an element are present as an impurity in a metal, only a few lines due to the impurity appear in the spectrum, and these can be recognised as additional lines by comparing the spectrum with that of the pure metal. These "raies ultimes" or persistent lines have been determined for all the usual elements, and tables giving their wavelengths are available.

The early pioneer work in this direction was done by Hartley, Pollok, Leonard and A. de Gramont, one of these being the Dr. Leonard, who was, unfortunately, prevented from lecturing instead of the author. When some experience has been gained, the distinctive groups of lines given by various commonly occurring impurities will be recognised at a glance.

Qualitative Analysis

The spectrum of an alloy shows lines due to all the metallic constituents, also silicon, phosphorus and boron, and with experience it is possible to judge which are the alloying elements and which are the impurities. The spectrograph is therefore an extremely useful adjunct to a chemical laboratory in giving an approximate indication of the principal constituents and impurities in an alloy of unknown composition. It is often useful in planning the chemical analysis, for example, to know beforehand whether certain elements are present or not.

Semi-quantitative Analysis

As the amount of an element in an alloy increases, the intensity of the lines due to this element also increases. A measure of the relative intensity of these lines is obtained from the blackening they produce on the photographic plate, and this is used to estimate the concentration of the element in question. The concentration is not usually determined directly from the intensity of the line, but the intensity of the impurity line is compared with that of a neighbouring line due to the basis metal ("internal standard method").

In cases where spectrographic analytical tables are available, the impurities present in an alloy can often be determined with sufficient accuracy by visual examination of the spectra and reference to such tables (compiled previously from the spectra of a range of accurately analysed standards). Methods of this type are rapid and they often suffice either as a rough check of composition or as a means of ensuring that impurities are below certain limits.

Accurate Analysis with the Microphotometer

The introduction of the microphotometer as a standard instrument for the measurement of line densities has been responsible for the remarkable increase in the accuracy of modern spectrographic analysis. With this instrument the errors due to the personal factor and the uncertainties of purely visual estimation are to a great extent removed. An enlarged image of the spectrum line is focussed on a photocell slit by means of a microscope objective, the light from a filament bulb being focussed on the line. The photocell is connected to a galvanometer, the scale reading giving a measure of the transmitted light. From this reading the density can be calculated.

The successful industrial application of the spectrograph in replacing chemical methods for analysis of non-ferrous alloys has so far been mainly confined to the control of production of particular types of alloy, the samples for analysis being in the cast condition. Before analysing any unknown sample, standards covering a range of composition are prepared and a

* A Paper read before the Birmingham and West Midlands Branch of the Institute of British Foundrymen. The Author is on the staff of the British Non-Ferrous Metals Research Association.

Metallurgical Spectrographic Analysis

calibration curve is obtained by plotting density differences (log ratios of galvanometer deflections) of selected pairs of lines ("internal standard method") against logarithm composition of the standards.

For non-ferrous alloys it has generally been found necessary to photograph spectra of both standard alloys and samples for analysis on each plate, although for steel analysis this does not appear to be necessary once the calibration curve has been determined for a particular set of working conditions and a particular batch of plates.

Effects of Alloying Constituents and Metallurgical History

It is generally agreed that the standard alloys used for the analysis of aluminium alloys should be closely similar, both as regards bulk composition and metallurgical history, to the samples for analysis. For this reason spectrographic methods for the analysis of samples of unknown metallurgical history cannot be regarded as reliable and are less extensively used. The re-casting of wrought materials for comparison is sometimes recommended; if this process is adopted, the possibility of loss by volatilisation of certain elements, notably zinc and magnesium, should be kept in mind.

Preparation of Electrodes

The electrodes are usually chill cast in the form of pencils 6 to 10 mm. dia. and 8 to 15 mm. in length, and the sparking ends are machined to a standard shape. The optimum conditions for casting vary for different types of alloy. The essential feature of the casting process is the production of a sample having a uniform fine-grain microstructure, free from porosity and from segregation of any of the constituents. It is important that the standard alloys and samples for analysis be prepared in exactly the same manner, and the pouring temperature and temperature of the die must therefore be controlled.

Analytical Accuracy

Since the average error of any spectrographic method is usually a percentage of the absolute amount to be determined, high percentages, *e.g.*, over 2.5 per cent., are generally more accurately estimated chemically. Spectrographic methods should be regarded as supplementing, but not entirely replacing, chemical analysis. They are most useful for those determinations which are long and tedious when carried out by ordinary chemical methods.

The reproducibility of spectrographic methods is usually determined statistically from the results of some 50 analyses on the same sample. A standard deviation of $\pm$ 5 per cent. of the amount present may be regarded as satisfactory, although lower errors have been reported. The spectrographic method is more automatic than the average chemical method, which allows greater opportunities for accidental errors on the part of the operator.

Further Work to Improve the Accuracy of Spectrographic Analysis

The B.N.F.M.R.A. has for some time been collaborating with its members in attempting to improve the accuracy of spectrographic methods. Four panels of the Research Sub-Committee dealing with this subject have been formed. The Photographic Panel has had the advice of the photographic experts in drawing up a recommended method for processing the plates to secure uniformity in development. The Aluminium and Lead Panels have recommended methods for the analysis of alloys of these metals and a further panel is concerned with the study of the basic problems common to all the methods.

One of the most important basic problems arises from the fact that, while each spectrographic laboratory can standardise a satisfactory technique for its own use, it does not follow that a method used in one laboratory will give the same results in another. This is an important point which has been brought to light as a result of the co-operative work of the Aluminium Panel. While methods for the analytical control of production of aluminium alloys are now well established, there is some divergence of opinion as to the best technique to be used.

Recent work has indicated that the main sources of error and disagreement arise from differences in superficially similar sparking circuits which give rise to variations in the spark itself. Attempts are now being made to determine the characteristics of the spark, and it is hoped that it will ultimately be possible to specify a spark circuit which can be relied upon to give identical and reproducible results.

The above comments have dealt with the analysis of non-ferrous metals and alloys, a branch of the subject with which the author is more familiar. F. G. Barker, of the Bragg Laboratory, Admiralty Inspection Department, Sheffield, has demonstrated the possibility of making quantitative determinations of several elements in alloy steels with an accuracy approaching that obtainable by chemical analysis.* With a modification of the technique, the method has been applied to the analysis of segregates,† and more recent work has shown how variations in composition across a segregate may be traced by means of the traversing micro-spark.‡

It has been said that spectrographic analysis is still more of an art than a science. On the other hand, there is already a vast accumulation of data available to guide those who are about to adopt this method. The metallurgists are now beginning to understand the problems and this is the first step to solving them.

* *Journal of the Iron and Steel Institute*, 1939, **139**, 211–255.
† F. G. Barker, J. Convey and J. H. Oldfield, *Ibid.*, 1941, **144**, 183-201.
‡ *Journal and Proceedings, Institute of Chemistry*, August, 1943 (4). 138–140.

SAVE PAPER WHEN YOU CAN

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

565,260 COGGAN, H. F. Machines for projecting sand and like material for making cores, sand-blasting and the like.

565,306 ELECTROFLO METERS COMPANY, LIMITED, and STONE, C. H. Open-hearth furnaces.

565,358 GALLUSSER, H. Reduction of iron ore.

565,427 BYRNE, E. L. W. (American Smelting & Refining Company). Machines for skimming metal billets.

565,439 FERRO ENGINEERING COMPANY. Hot-tops for ingot moulds.

565,520 CUTANIT, LIMITED, and LITTMANN, M. Production of bodies formed of or comprising metal powder or powdered metallic compound.

565,567 DU PONT DE NEMOURS & COMPANY, E. I., and GILBERT, H. N. Removal of surface impurities from metals by fused alkali baths.

565,590 WEBB, G. W., and PROCTOR, W. F. Method of melting metals and other mouldable substances.

565,598 ELECTRO METALLURGICAL COMPANY. Manufacture of cast iron.

565,615 WOLSINGHAM STEEL COMPANY, LIMITED, and LIDDLE, T. Manufacture of rudder frames.

565,663 AVON DIECASTING COMPANY, LIMITED, and WALTERS, S. A. Cast metal plates or boxes.

565,835 BLISS COMPANY, E. W. Rolling mills.

565,839 HORDERN, MASON & EDWARDS, LIMITED, EDWARDS, W. G., and WILSON, G. S. Metal-working presses.

565,861 DEHN, F. B. (Beardsley & Piper Company). Sand moulding machines.

565,865 HUGHES, W. Synchronised control gear for two machines which have to work in conjunction with each other, such as coke-oven machinery and the like.

565,866 THERMAL SYNDICATE, LIMITED, and PEEL, G. N. Process for the manufacture of refractory articles.

565,886 BABCOCK & WILCOX, LIMITED. Fusion welding.

565,887 BIRMINGHAM ELECTRIC FURNACES, LIMITED, ROBIETTE, A. G. E., and HANCOCK, P. F. Heat-treatment of iron or iron alloy castings.

565,906 FLOWERS, P. E. Devices for moving cores for casting or other reciprocating elements.

565,946 BIRMINGHAM ELECTRIC FURNACES, LIMITED, ROBIETTE, A. G. E., and HANCOCK, P. F. Decarburisation of austenitic manganese cast-iron alloys.

566,043 MALLORY METALLURGICAL PRODUCTS, LIMITED, and TUCKER, N. A. Gauge for use in connection with electric spot welding.

566,053 MAGNESIUM ELEKTRON, LIMITED, FOX, F. A., FISHER, A., and WILKINSON, R. G. Magnesium base alloys.

566,094 PYRENE COMPANY, LIMITED, CLIFFORD, W. J., and ADAMS, H. H. Materials for use in forming phosphate coatings on metals.

FORTHCOMING EVENTS

JANUARY 23 and 24.

Iron and Steel Institute:—Joint meeting with the Lincolnshire Iron and Steel Institute. Paper on "Ironmaking at the Appleby-Frodingham Works of the United Steel Companies, Limited," by G. D. Elliot and his colleagues. At the Technical School, Cole Street, Scunthorpe, at 7.30 p.m. each evening.

Institute of British Foundrymen

JANUARY 22.

Sheffield Branch:—"Joint meeting with the Iron and Steel Institute. Discussion of a Paper by W. Davies and W. J. Rees on "The Effect of Grain Shape on the Moulding Properties of Synthetic Moulding Sands." At the Royal Victoria Hotel, Sheffield, at 7 p.m.

JANUARY 24.

London Branch:—"Gunmetal Bearings," by F. Holligan. At the Charing Cross Hotel, London, W.C.2.

JANUARY 27.

East Midlands Branch:—"Moulding Sands and Gases in Relation to Casting Defects," by G. W. Nicholls. At the Technical College, Derby, at 6 p.m.

BOOK REVIEW

Alloy Cast Irons—Second Edition. Edited by a Committee of the American Foundrymen's Association, and published by that body from 222, West Adams Street, Chicago, 6, Ill., U.S.A.

The reviewer accorded an enthusiastic welcome to the first edition of the book. It is first-class publicity for the accomplishment of the grey-iron foundry industry, apart from supplying the foundry executive with reliable data for the prosecution of his daily tasks. This second edition has been partially re-edited with a view to stressing economy in the use of alloys during the period of their stringency. This has been done in such a way as to retain the long view, that is to help in the development of this range of alloys. It is interesting to learn that tellurium additions are now being used commercially in the States for communicating an extra hard-chilled surface.

V. C. F.

A NEW FILM ON WELDING

Suffolk Iron Foundry (1920), Limited, of Stowmarket, have just completed a 16 mm. silent film showing in detail a Sifbronze welding repair to a cast-iron tractor gear casing. Copies of this film, which requires approximately 15 minutes to display, are available on loan free of charge from the company.

It is considered that the film has good instructional value, clearly showing the sequence of operations and procedure required to complete successful Sifbronze welding repairs to castings of large size and complicated shape. Requests for the film will be dealt with in strict rotation, and it is suggested that applications should be made at least four weeks in advance of the date when the film is required for display.

NEWS IN BRIEF

NO FEWER THAN 13,657 wagons were unloaded and turned round at a magnesium works in Manchester during the two years ended September 30, 1944, without incurring a single day's demurrage.

THE MINISTRY OF SUPPLY announces that compulsory certificate procedure as affecting all pistons ordered for civil use is discontinued. Certificate procedure in respect of cylinder liners remains.

NOTICE IS GIVEN in connection with the affairs of Walter Arnold Blackburn, 29, Broadway North, Walsall, retired ironfounder, of the release of the trustee. Mr. R. K. Clark, Somerset House, 37, Temple Street, Birmingham, 2, as from December 22, 1944.

MR. GEO. W. WOLF, president of the United States Steel Export Company, has announced that, with Gary tubes as the basis, rocket production by the National Tube Company, a U.S. Steel Corporation subsidiary, has passed from experiment to full production.

MR. HUGH DALTON, President of the Board of Trade, speaking at Durham, said that all Government factories would be fully used in the future whether for producing munitions or for peacetime purposes. There was no lack of applications from suitable tenants for more than all the new factories at the Government's disposal, he stated.

A PETITION for the winding up of Itabira Iron Ore Company, Limited, has been presented by the Solicitor for the Treasury. The whole of the company's share capital of £935,000 was acquired by the Government under compulsory powers in March, 1942. The company owned iron ore mines in Minas Geraes, which were subsequently acquired by Brazil.

THE BOARD OF TRADE announces that in view of Sir Frank Nixon's preoccupation as a joint managing director of the United Kingdom Commercial Corporation, Mr. E. C. Adams has been appointed to act as head of the Export Credits Guarantee Department with effect from January 1, 1945. Sir Frank Nixon will continue as a member of the Advisory Council.

RICHARD THOMAS & BALDWINS, LIMITED, are creating £2,500,000 of 3½ per cent. loan stock, 1945-55, which the firm of Baring Bros. has undertaken to purchase. The proceeds are to be used towards repayment of the existing £2,917,182 4 per cent. prior lien debenture stock, which is being called for redemption. The difference of £417,182 will be paid out of existing moneys.

SIR JOHN WADDINGTON, Governor of Northern Rhodesia, surveying the prospects for the production of copper in Northern Rhodesia when he opened the Session of the Legislative Council, said that for the first quarter of 1945, Northern Rhodesian producers had obtained contracts from the United States, which, with the purchases of the British Ministry of Supply, would absorb the greater part of the output at the present rate. What would happen after the first quarter would depend on discussions which would be resumed in London early this year.

MACHINERY, PLANT AND APPLIANCES CONTROL

Under the Machinery, Plant and Appliances (Control) (No. 9) Order, 1945 (S.R. & O., 1945, No. 6), in force on January 15, the Board of Trade are empowered to grant licences to manufacturers to supply the machinery, plant and appliances controlled under previous Orders. The Board propose in future to grant only such licences, the existing power to grant licences to persons to acquire controlled goods being retained solely in view of outstanding licences issued to such persons. It will thus be necessary, in future, for the manufacturer, and not the acquirer, to make all applications for licence, forms for that purpose being obtainable from the Industrial Supplies Department, Machinery Licences Division, Board of Trade, 1-6, Tavistock Square, London, W.C.1.

Further, reconditioning is no longer to be regarded as "manufacture," and parts for reconditioning, in addition to parts for repair, will now be exempt from control.

NEW FACTORIES IN THE N.E.

Details have been made public of plans for helping to maintain employment at a high level in the North-East area after the war. The plans include Government proposals for trading estates at the Hartlepools and near Jarrow. The St. Helen's Estate, Bishop Auckland, and the Pallion Estate at Sunderland are to be extended. Seven large Government factories are to be built at Barnard Castle, Tynemouth, Bishop Auckland, South Shields, Sunderland, the Hartlepools and Middlesbrough. These will be employed on war work at first, and afterwards, it is hoped, they will be adapted to peacetime uses. Other new factories are contemplated to serve Blyth, Langley Moor, Craghead, Shildon, Jarrow and Guisborough. Various private firms have, it is stated, submitted plans for extending their premises. Mr. Sadler Forster, regional representative of the Board of Trade, stated that the new trading estates would in time provide 2,000,000 sq. ft. of factory space.

NORTH-EAST ENGINEERING BUREAU

The following have been elected to the board of management of the newly-formed North-East Engineering Bureau, which is intended to help in the expansion of the engineering industry, and give advice to engineering firms:—Col. E. C. Angus (George Angus & Company, Limited), Mr. D. G. Brown (Redheugh Iron & Steel Company, Limited), Col. B. H. Leeson (A. Reyrolle & Company, Limited), Mr. R. W. Mann (Victor Products (Wallsend), Limited), Mr. J. E. Steel (Steel & Company, Limited), Mr. H. Wright (R. Powley & Sons), Mr. J. H. Arthur (Ashmore, Benson, Pease & Company, Limited), and Mr. R. L. Clark (John Tinsley, Limited). The secretary is Mr. J. E. Spoors. The Bureau has now 94 member-firms, subscribing about £6,000 annually. A general manager is to be appointed.

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COMPANY RESULTS

(Figures for previous year in brackets.)

T. M. Birkett & Sons—Interim dividend of 5% (same).

J. Samuel White—Final dividend of 4% net (same), making 6½%, tax free (same).

Tomlinsons (Rochdale)—Net profit to June 30 last, £10,194 (£7,030); dividend of 10% (same); forward, £6,533 (£8,755).

Weardale Lead Company—Loss for the year to September 30 last of £1,881, increasing the debit balance brought forward to £2,618.

Thomas Danks & Company—Net profit to September 30, £4,605 (£6,647); tax, £3,000 (£4,500); ordinary dividend of 7½% (same); forward, £1,381 (£1,076).

Alexander Hall & Company—Net profit for the year ended July 16, 1944, £5,051; depreciation, £4,059; ordinary dividend of 2½%; forward, £20,652 (£19,973).

Universal Asbestos Manufacturing Company—Profit for the year ended on October 1, £110,652 (£112,401); E.P.T., £59,000 (£60,000); income-tax, £31,500 (£31,000); ordinary dividend of 20% (same); forward, £63,758 (£59,039).

Turner & Newall—Profit for the year to September 30 last (including dividends from subsidiary companies), after providing for expenses, bad and doubtful debts, mines amortisation and contingencies, and after provision of £178,526 by subsidiary companies for U.K. income-tax liability, £2,513,915 (£2,710,801); depreciation, £215,716; taxation, £1,750,380 (£1,955,667); net profit, £545,665 (£553,293); final dividend of 8½%, making 12½% (same); to general reserve, £100,000 (same); forward, £112,847 (£99,457).

OBITUARY

MR. GEORGE R. ARMSTRONG, engineer manager on new construction for Henry Robb, Limited, Leith, died recently. He had served with the company for 20 years.

MR. WILLIAM FRANK TAYLOR, chairman and managing director of E. Baylie & Company, Limited, chain manufacturers, of Stourbridge, died on January 6, in his 77th year.

MR. JAMES HARRY EDWARDS, J.P., chairman and managing director of the Middle Docks & Engineering Company, Limited, South Shields, died on January 5. He was 74.

MR. ALBERT JEAVONS, of Wolverhampton, died recently at the age of 68. He was a former director and works manager of John Thompson (Wolverhampton), Limited, a subsidiary company of John Thompson Engineering Company, Limited, Wolverhampton, with whom he had been associated for more than 52 years.

MR. JAMES WALKER, M.P. for Motherwell, died on January 5 following a road accident. Mr. Walker, who was organiser of the Iron and Steel Trade Confederation, had been M.P. for Motherwell since 1935, and was a former chairman of the Labour Party. He was 60, and began his working life as a steel melter in Scotland.

PERSONAL

MR. H. C. RANDELL has retired from the board of Walmsleys (Bury), Limited.

SIR CLIVE BAILLIEU has been nominated for election as president of the Federation of British Industries for the ensuing year.

LT.-COL. J. A. T. BARSTOW and MR. W. CYRIL WILLIAMS have been elected to the board of Beyer, Peacock & Company, Limited.

MR. E. W. OAKES has joined the Sandiron group of companies, controlled by Hinckleys, Limited, Sandiron House, Beauchief, Sheffield, as director of production.

MR. A. R. CHAPMAN, who has been deputy general sales manager of Babcock & Wilcox, Limited, since January 1, 1944, has now been appointed general sales manager.

SIR PHILIP WIGHAM RICHARDSON has been appointed chairman of Swan, Hunter & Wigham Richardson, Limited, shipbuilders, in succession to the late Sir Charles Swan.

MR. R. O. HERFORD, managing director of the Renold & Coventry Chain Company, Limited, has been awarded the O.B.E. Until lately Mr. Herford was serving as Controller of Inspection (Administration) in the Ministry of Supply, London.

MR. AND MRS. J. J. WALTON, of Goldthorn Hill, Wolverhampton, have celebrated their golden wedding. Mr. Walton, who is 75, has been a director of Samuel Thompson & Company (Millfields), Limited, ironfounders, with whom he has been for 48 years. Until ten years ago he was also works manager.

MR. JAMES WILLIAMSON has resigned his appointment as chief engineer and director of Sir William Arrol & Company, Limited, as at December 31, and MR. GILBERT ROBERTS has been appointed to succeed him. Mr. Williamson, who was a member of the Cooper Committee, which reported on hydro-electric development in Scotland, is to act as one of the civil engineering consultants for several of the proposed hydro-electric schemes.

MR. FRED HOYLAND, chairman of the Works Advisory Committee of Newton, Chambers & Company, Limited, Thorncliffe, Sheffield, received the M.B.E. in the New Year Honours List for services to industry. He entered the company's employment 55 years ago. He was for many years in coke-oven management, and later became works superintendent of the chemicals branch of the company. He is a past-chairman of the Factory Managers' Association, and an associate member of the Institution of Mechanical Engineers and of the Coke-Oven Managers' Association.

WOLFRAM PRICE REDUCED

The Ministry of Supply announces that the price of tungsten ore has been reduced to 90s. per unit of WO_3 delivered consumer works. Any inquiry should be addressed to the Adviser for Wolfram to the Chrome Ore, Magnesite and Wolfram Control, Steel House, Tothill Street, London, S.W.1.

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Raw Material Markets

IRON AND STEEL

There has been a recession of late in the demand for light steel sections, small steel bars and heavy sheets, and in consequence reduced pressure for billets, blooms and sheet bars. On the other hand, light-gauge sheets are on order in very large quantities and fulfilment of orders already booked will call for maximum production to the end of the first quarter of the year.

Scarcity of orders for heavy steel plates, joists and channels still persists, and hopes of increased support from the shipbuilding industry have not yet been realised. In the general and electrical engineering trades there is a huge potential demand which is banked up until peace production is permissible. Meanwhile, the rail mills are very busy and collieries have again been allotted generous quotas of material in the form of arches, bars and props. All the wire mills have heavy commitments and locomotive and wagon builders, operating to the limit of their capacity, are able to obtain ample and regular delivery of steel plates suitable for their needs.

The retention of a rigid control is clearly indicated in the issue of licences for pig-iron for the current quarter. Requirements in general are not in excess of recent deliveries and increased quotas are only sanctioned in special cases. Ironmasters are maintaining a regular flow of supplies to the foundries, but might have difficulty in doing so if these establishments were working at anything like their normal pace. The blast furnaces are amply supplied with native ore and limestone, but little cargo space has recently been allotted for the import of high-grade foreign ores, and the domestic situation in regard to coke is still tight.

NON-FERROUS METALS

Stepping up of the production of brass strip for small arms and gun ammunition will mean an additional call for copper and zinc. It should be possible to meet these needs without tightening up in any way the restrictions on the use of metal in other directions. All told, a relatively small tonnage has so far been released for ordinary civilian purposes, and such concessions as have been made will probably remain. At the same time, it seems unlikely that the Control will view favourably any further relaxation of the restrictions, at least for the time being. Renewed efforts to conserve stocks of copper are reported from the United States, and action of this nature must inevitably reflect on the position over here. America has recently increased her purchases of copper.

The situation in lead and zinc shows very little change. Requirements for war purposes are readily forthcoming, and fair releases are being made in other directions. A close watch continues to be kept on the distribution of tin, but aluminium is not too difficult to secure.

PARKGATE IRON & STEEL COMPANY'S CAPITAL

The directors of the Park Gate Iron & Steel Company, Limited, propose to reduce the capital from £2,000,000 to £1,000,000 by cutting 10s. off each £1 unit of ordinary stock. In a circular to stockholders they state that they have had under consideration the future policy of the company, and they feel that before new plans can be put into operation it is essential to rectify the capital structure.

The directors have felt for some time that the capital is inflated, and a formal valuation of the works recently made indicates that the present value is not more than £1,150,000. With the handicap of the inflation of capital removed the directors believe that the company can look forward to a successful future.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Westcliff Engineering Company, Church Street, Ware, Herts—£5,000. R. J. and E. F. Willgoss.

George Hodkin, 146, Haworth Road, Hounslow, Middlesex—Engineers, etc. £2,000. G. F. D. Hodkin.

Metal Spinning Company, Ace Works, Queen Victoria Road, Coventry—£100. N. Ryecroft and J. A. Corner.

Out Engineering Company, 119, Cross Street, Sale, Ches—£1,000. J. R. Hoyland, R. Jenkinson, A. E. H. and L. C. Kays.

Henry Born, 236-242, Barking Road, East Ham, London, E.6—Engineers, etc. £3,000. H. C. Born and F. N. Cartwright.

Franklin Howes (Engineers), Church Road, Churchdown, Glos—£1,000. A. J., A. C., and V. E. Franklin and W. E. Howes.

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